sewage works, that they may know what tricks may be attempted. It is commonly said 'that any stick is good enough to beat a dog with,' and on a similar principle, any unfair, dishonourable stratagem is held legitimate to bring discredit on a process for the chemical treatment of sewage." "Another necessary precaution relates to sampling. If any visitor asks for a sample, it should be given him solely on the condition that he takes and seals up at the same time a check sample, to be left at the works for analysis by some independent chemist. Without this precaution he may, for instance, add to his sample a little urine or blood, or a culture solution, and still represent it as a normal sample" (p. 170). These passages serve to show the opinion in which the author holds his brother experts.

It is very plain that the author rejects *in toto* all experience but what is favourable to his own views. The following passage is a specimen of the assertions constantly made throughout the book:—"Just in proportion as a sewage is purified by precipitation, its manurial value for irrigation will decrease down to that of plain water" (p. 70). This statement, which implies that complete purification is attainable by precipitation processes, is at total variance with the truth, and has been disproved over and over again; but it is a sufficient index of the kind of treatment the subject throughout receives.

On the subject of sewage manures the author quotes, as representative of their average composition and value, the results of Dr. Tidy's analysis of the sewage manure from the "A.B.C." process at Aylesbury. Can the author not be aware that the Aylesbury manure has become one of the wonders of the scientific world? How is it that the "A.B.C." process can convert a nearly worthless substance—sewage sludge—into a rich and paying manure? Can the author tell us?

OUR BOOK SHELF.

The International Annual of Anthony's Photographic Bulletin. Edited by W. Jerome Harrison, F.G.S., and A. H. Elliot, Ph.D. (London: E. and H. T. Anthony and Co., 1888.)

IN the pages of this volume we have a valuable collection of articles written by men many of whom are eminent in the art and science of photography.

At the present day, considering the great number working, either as amateurs or professionals, at this subject, and that that number is still on the increase, and also the numerous books that have been published, one would think it hard for another work to differ a great deal from those preceding it. The editors, in their preface, tell their readers to "partake of and enjoy the feast that they have set before them; and, if the viands tickle their palates, praise rather the maker of that particular dish than those who have spread the table."

The present work consists of a popular account of nearly every branch of the subject, including stellar photography.

The volume is beautifully illustrated by specimens of various methods of printing, engraving, &c. The appendix contains a list of Photographic Societies of the British Isles, colonies, and of America, with numerous tables.

The editors have produced a volume which will not only be appreciated by members of the photographic world, but will be interesting to any ordinary reader.

Instruction in Photography. By Captain W. de W. Abney, C.B., R.E., F.R.S. Eighth Edition. (London: Piper and Carter, 1888.)

ALL that is needed for photographers, whether amateur or professional, will be found in this well-known book, which has been thoroughly revised and brought up to date. By the addition of new matter the volume has been slightly increased, and an alteration of some importance consists in the introduction of both the French and English measures for the various formulæ used throughout.

The work is profusely illustrated, and the least we can say is that no studio ought to be without it.

Lessons in Elementary Physics. By Balfour Stewart, M.A., LL.D., F.R.S. New and Enlarged Edition. (London: Macmillan and Co., 1888.)

THE present edition of this well-known book was prepared only in part by the late author. The task has been completed by Mr. W. W. Haldane Gee, B.Sc., Lecturer of the Victoria University. No material alterations have been made, except in the chapters relating to electricity and magnetism, which have been rearranged, and expanded by the addition of new matter and figures.

LETTERS TO THE EDITOR.

[*The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts intended for this or any other part of* NATURE. *No notice is taken of anonymous communications.*]

Supposed Fossils from the Southern Highlands.

IN the article in your last number upon my paper lately read before the Royal Society of Edinburgh, respecting the discovery of some supposed annelid tubes in the quartzites of Loch Fyne, some observations are made on the interest attaching to the question as bearing on the geological horizon of the metamorphic series which constitute the great bulk of the South-Western and Central Highlands. With reference to this question, however, I am anxious to disclaim attaching any great importance to the discovery of annelids, because I do not admit that any real doubt exists as to the Silurian horizon to which our rocks were referred by Murchison. In this country, particularly, the evidence seems to me complete whether fossils be, or be not, found in them; because in this country we have complete stratigraphical evidence from the occurrence of a small local coal-basin in the district of Kintyre. The backbone of that long peninsula consists of the same metamorphic rocks as the rest of the country. Along its shores it is fringed by cakes of Old Red Sandstones which have resisted denudation, or have survived destructive dislocations. At the southern end of the peninsula these sandstones have survived in considerable masses—including beds of conglomerate, of freestone, and of limestones. All these beds rest unconformably on the metamorphic schists and limestones, whilst they are, again, also to be seen dipping and passing under the coal-measures and Carboniferous limestones in their usual and natural order. There can be no doubt of the order of succession in this case, and it establishes the position of our metamorphosed slates and quartzites as rocks which belong to the horizon below the Old Red.

Of course, the discovery of fossils would put an end to the new surmise that they are not sedimentary deposits at all, but intrusive rocks, simulating true bedding in consequence of "foliation," or some other process of mineralization. But this surmise is so wild that I feel no doubt about its early disappearance.

In this, I believe Dr. Geikie entirely agrees; and he has consequently expressed a confident expectation that fossils will be found in our schists and quartzites some day.

I may add that since my return from Edinburgh a correspon-

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dent has sent to me an unmistakable specimen of annelid piping from a rock at Killin. Now that we are all on the scent, I have no doubt that my Loch Fyne worms will be found at the head of a long procession. ARGYLL.

Inveraray, January 28.

Mr. Howorth on the Variation of Colour in Birds.

PERMIT me to point out that the fact cited by Mr. Howorth (*anteà*, p. 294), of the similarity between the birds of Western Europe and those of Japan, which, according to him, illustrates "from an unexpected quarter" the views expressed in his work "The Mammoth and the Flood," is by no means so novel as the general reader might, from his communication, suppose. On the contrary, it has been before the world for more than half a century, and is, or ought to be, familiar to every well-informed ornithologist, since it was in 1835 that Temminck gave ("Manuel d'Ornithologie," Part 3, Introd. pp. l.–liii.) a list of 114 species of birds, which he said were common to the Japanese Empire and to Europe. It has subsequently been shown that this number was exaggerated; but, as observed in 1857 by Mr. Sclater, in his classical paper on the geographical distribution of birds, "there can be no question as to the general strong resemblance of the Japanese avifauna to that of Europe" (Journ. Linn. Soc., Zoology, ii. p. 134).

That the birds of Siberia differ in appearance from those of Japan and of Western Europe has also been abundantly shown by the long succession of illustrious explorers and naturalists from whom we derive all but an infinitesimally small portion of our knowledge of Siberian and Central Asiatic zoology; but Mr. Howorth does not seem to be aware that another hypothesis has usually been brought forward to account for that difference, as well as for the similarity of the Japanese avifauna and our own. In regard to the latter, this hypothesis has been propounded to my certain knowledge for more than five-and-twenty years (*Ibis*, 1863, p. 189); and, whether true or false, has not, so far as I am aware, been refuted. It is that the resemblance is an effect due to "the prevalence in both localities of an insular, as opposed to a continental climate," for it has been observed over and over again in various parts of the world (and not only in birds) that island forms possess a darker coloration than their continental representatives (*cf.* Gould, Proceedings of the Zoological Society, 1855, p. 78), while the fact that neither British nor Japanese birds exhibit the brilliant hues of their continental kinsfolk is notorious.

Another remark upon Mr. Howorth's communication I would offer. His theory, of which he has "little doubt," that "the willow grouse of the Continent is an altered form, and that our red grouse is the parent," is not new, but was definitely stated some eight or nine years ago in the "Encyclopædia Britannica," from the article "Grouse" in which I venture to quote a passage showing that there is a side of the question which he does not seem to have considered.

"A very interesting subject for discussion would be whether *Lagopus scoticus* or *L. albus* has varied most from the common stock of both. We can here but briefly indicate the more salient points that might arise. Looking to the fact that the former is the only species of the genus which does not assume white clothing in winter, an evolutionist might at first deem the variation greatest in its case; but then it must be borne in mind that the species of *Lagopus* which turn white differ in that respect from all other groups of the family *Tetraonidæ*. Furthermore, it must be remembered that every species of *Lagopus* (even *L. leucurus*, the whitest of all) has its first set of *remiges* coloured brown. These are dropped when the bird is about half-grown, and in all the species but *L. scoticus* white *remiges* are then produced. If, therefore, as is generally held, the successive phases assumed by any animal in the course of its progress to maturity indicate the phases through which the species has passed, there may have been a time when all the species of *Lagopus* wore a brown livery even when adult, and the white dress donned in winter has been imposed upon the wearers by causes that can be easily suggested, for it has been freely admitted by naturalists of all schools that the white plumage of the birds of this group protects them from danger during the snows of a protracted winter. On the other hand, it is not at all inconceivable that the Red Grouse, instead of perpetuating directly the more ancient properties of an original *Lagopus* that underwent no great seasonal change of plumage, may derive its ancestry from the widely-ranging Willow-Grouse, which, in an epoch comparatively recent (in the geologica sense), may have stocked Britain, and left descendants that, under conditions in which the assumption of a white garb would be almost fatal to the preservation of the species, have reverted (though doubtless with some modifications) to a comparative immutability essentially the same as that of the primal *Lagopus*."

In conclusion, let me recommend those interested in the local variation of colouring in the plumage of birds to study Gloger's "Das Abändern der Vögel durch Einfluss des Klimas" (Breslau, 1833), a treatise which, though naturally out of date in many respects, contains much that ornithologists would be the better for not overlooking. ALFRED NEWTON.

Magdalene College, Cambridge, January 26.

Constitution of the Chlorides of Aluminium and the Allied Metals.

IN NATURE of December 27 (pp. 198–200), Dr. Young has directed the attention of your readers to the formulæ of the so-called hexachlorides, R_2Cl_6, and bodies of similar constitution. As this question possesses a great theoretical interest, I may be allowed to say a few words about it.

The constitution of the chlorides R_2Cl_6 was regarded by Friedel as analogous to that of carbon hexachloride, $Cl_3\equiv C-C\equiv Cl_3$, and the metals themselves were said to be tetravalent. Mendelejeff, in his classical paper on the periodic law—a gem of chemical literature—was the first to point out that it is not necessary to regard aluminium in Al_2Cl_6 as tetravalent, but that a compound of this formula represents only a molecular combination—a polymeric state—of $AlCl_3$. This view was very little regarded by chemists. It was, ten years later (Proc. Vienna Acad., 1882), extended by the author of the present lines, to other bodies of similar constitution, and it was shown that several chlorides give a vapour consisting partly or entirely of polymeric modifications of the simple chloride. So we have the molecules $Sn_2Cl_4-SnCl_2$, $Fe_2Cl_4-FeCl_2$ ($N_2O_4-NO_2$), and it was supposed that other substances of similar constitution would split up into simpler molecules, if they could bear higher temperatures, especially Al_2Cl_6, aluminium belonging to a natural group of *triad* elements, whose other members, viz. B and In, give chlorides of the simple and molecular formulæ, BCl_3 and $InCl_3$. As further instances of the above case may be quoted to-day, H_2F_2-HF, $Be_2Cl_4-BeCl_2$, $Ga_2Cl_6-GaCl_3$.

It may, however, be useful to those readers of NATURE who cannot follow completely the current chemical literature, to know that the values of vapour-densities obtained by Dumas's method are not strictly comparable with those obtained by V. Meyer's method; for, as has been shown lately by Victor Meyer and his pupils, especially Biltz, the vapour density of dissociable substances is found smaller by V. Meyer's apparatus than by that of Dumas at one and the same temperature. So Dumas's method shows, for the above chlorides, the existence of double molecules at a temperature at which that of V. Meyer indicates single molecules. It was already pointed out by Dr. Young that the single molecules, $GaCl_2$, $InCl_2$, $InCl_3$, and $CrCl_3$, were found by V. Meyer's method only, and there is no doubt that some of them may be found double by Dumas's method.

The result of the vapour-density determinations of aluminium chloride and the chlorides of the allied metals, carefully collected by Dr. Young in NATURE, is of great theoretical importance, for, as the chlorides RCl_3 exist as single molecules in the gaseous state, the respective metals are undoubtedly *trivalent* in these compounds.

But the question arises, what is the valency of these metals when their chlorides have the double molecule R_2Cl_6?

It is impossible to regard these compounds as analogous to carbon-hexachloride and the said metals as tetravalent, for that compound, when heated to a higher temperature, does *not* split up into two molecules, CCl_3, as the chlorides R_2Cl_6 do. Moreover, it must be admitted that the theory of valency which was developed by the study of organic compounds (*carbon* derivatives) does not strictly hold good in the case of the remaining elements. It is impossible to state the number of "bonds" by which the chlorides RCl_3 are kept together in double molecules, R_2Cl_6. This number is certainly not *one* (Cl_3R-RCl_3); just as two molecules of $SnCl_2$ in Sn_2Cl_4 cannot be regarded as being united by one bond, $Cl_2Sn'''-Sn'''Cl_2$, for no one will assume that tin is trivalent in this compound. If we admit any bonds at all between the two Sn atoms, we must admit two, $Cl_2Sn=$

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